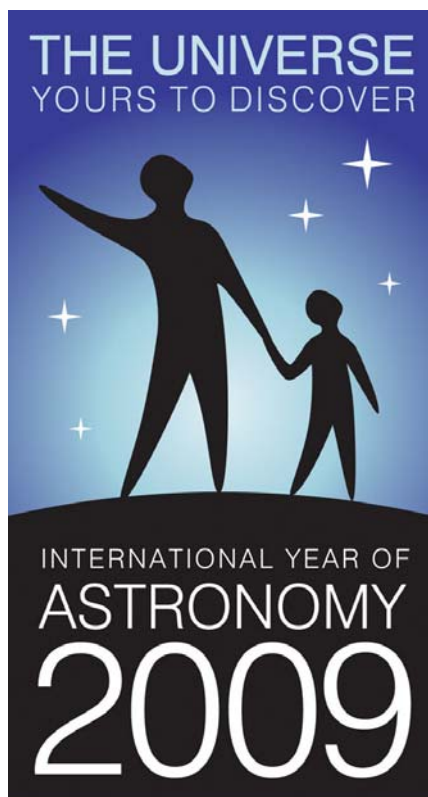


March 2009

IYA Discovery Guide



This Month's Theme:

Observing at Night ...and in the Day

Featured Activity:

Light Pollution and Shielding

Featured Observing Object:

Saturn

The International Year of Astronomy is a global celebration of astronomy and its contributions to society and culture, highlighted by the 400th anniversary of the first use of an astronomical telescope by Galileo Galilei.

Join us as we look up! <http://astronomy2009.us>



The Astronomical Society of the Pacific increases the understanding and appreciation of astronomy by engaging scientists, educators, enthusiasts and the public to advance science and science literacy.

<http://www.astrosociety.org>

March's Topic

Observing at Night... and in the Day

The telescope that Galileo first used to look out into the universe was very small by today's standards. But he did have one advantage when he started stargazing – dark skies. For most of human history and up until about 50 years ago, most people could step outside and see countless stars at night. But these days how many we see depends a lot on where we're standing. What can you find when you look up at night? In a bright city many people only see a few of the brightest objects.

The difference between a dark and bright sky is the amount of [light pollution](#). This means the extra light that escapes skyward from our streetlights, and porch lights, and other bright places. This light pollution makes stargazing harder, but it also disrupts the breeding and migration cycles of many wild things. And all of the light that escapes upward is just energy being wasted.



Luckily, there is something we can do about it. By making smart lighting choices we can reduce our impact on the night sky and the environment and save energy while we're at it. A great place to start this month is to become part of the [GLOBE at Night](#) citizen science project, from March 16-28, 2009. Join a worldwide campaign to record the light pollution where you are by observing the stars in the night sky. Then be sure to follow up with recommendations in the attached handout and ideas from the [International Dark-Sky Association](#).

Speaking of stars, what is the brightest star in the sky? Be careful, it's a trick question. It's our Sun, the closest and most important star to Earth. NASA has many missions dedicated to studying the Sun such as [SOHO](#), [Hinode](#), and [STEREO](#) that are giving us great 3D images of the surface activity. [Sun-Earth Day](#) is an annual celebration of the Sun and its effects on Earth. Register to receive updates and [Sun-Earth Packets](#). Celebrations include podcasts and vodcasts, educational materials, museum programs, and [Solar Week](#).

The activity included in this Discovery Guide will demonstrate what a difference good lighting can make for your safety and to reduce light pollution. With a few simple materials, you can show friends and family how they can make a difference too.

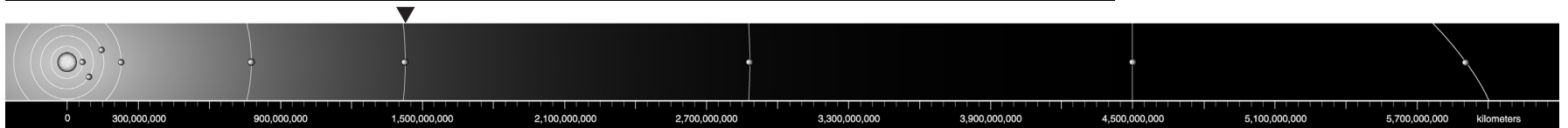
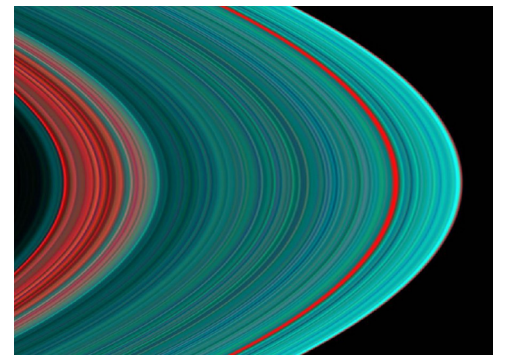
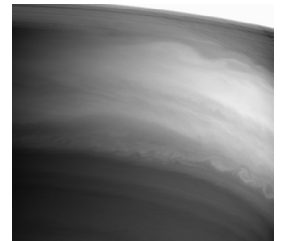
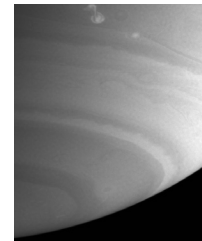
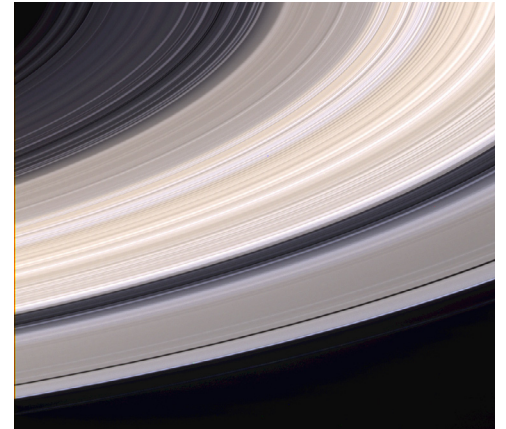
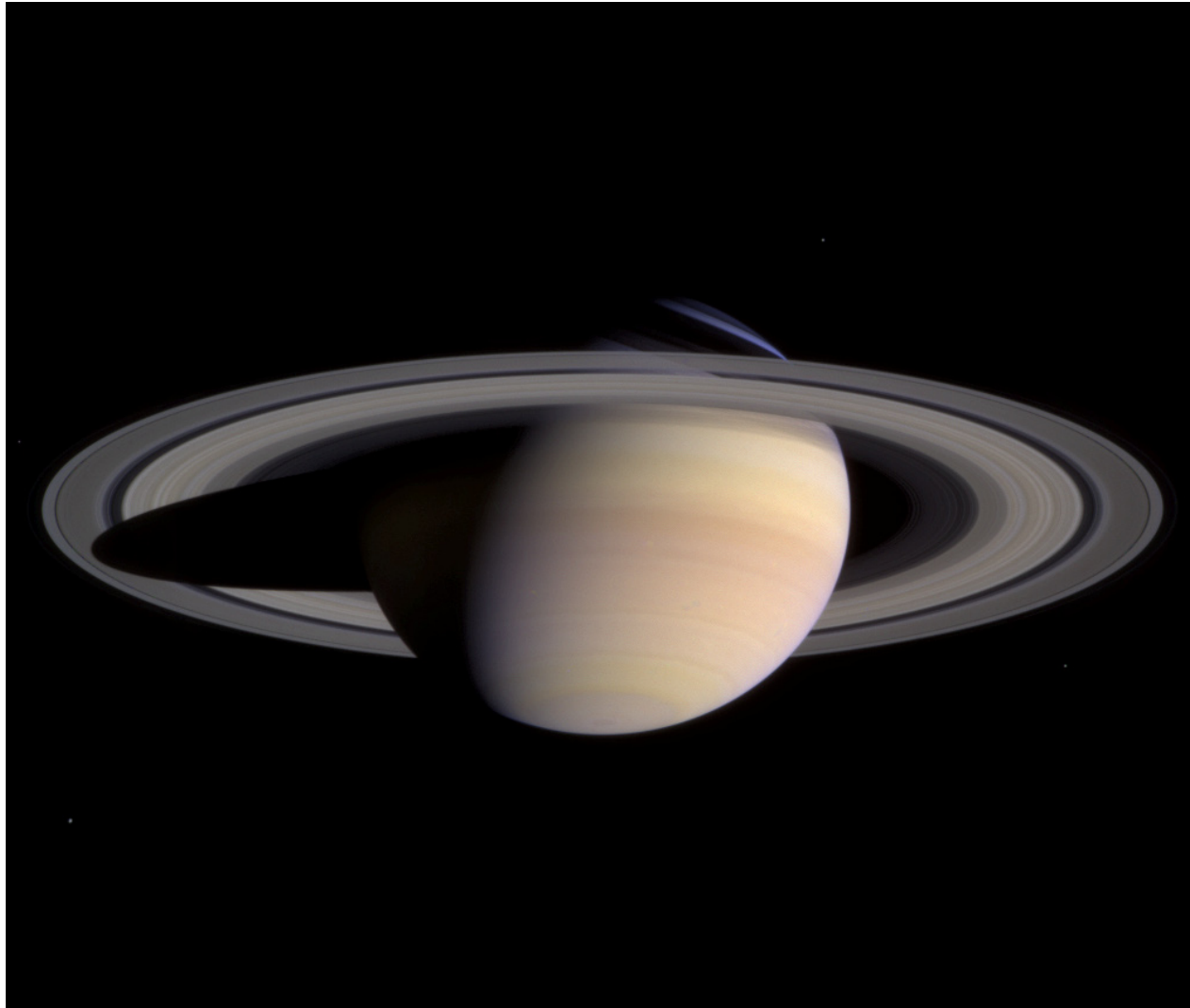
Learn more about Observing at Night...and in the Day from [NASA](#).

Find more [activities](#) featured during IYA 2009.

See what else is planned for the [International Year of Astronomy](#).



Saturn



Saturn



Saturn was the most distant of the five planets known to the ancients. In 1610, Italian astronomer Galileo Galilei was the first to gaze at Saturn through a telescope. To his surprise, he saw a pair of objects on either side of the planet. He sketched them as separate spheres and wrote that Saturn appeared to be triple-bodied. Continuing his observations over the next few years, Galileo drew the lateral bodies as arms or handles attached to Saturn. In 1659, Dutch astronomer Christiaan Huygens, using a more powerful telescope than Galileo's, proposed that Saturn was surrounded by a thin, flat ring. In 1675, Italian-born astronomer Jean-Dominique Cassini discovered a "division" between what are now called the A and B rings. It is now known that the gravitational influence of Saturn's moon Mimas is responsible for the Cassini Division, which is 4,800 kilometers (3,000 miles) wide.

Like Jupiter, Saturn is made mostly of hydrogen and helium. Its volume is 755 times greater than that of Earth. Winds in the upper atmosphere reach 500 meters (1,600 feet) per second in the equatorial region. (In contrast, the strongest hurricane-force winds on Earth top out at about 110 meters, or 360 feet, per second.) These super-fast winds, combined with heat rising from within the planet's interior, cause the yellow and gold bands visible in the atmosphere.

Saturn's ring system is the most extensive and complex in the solar system, extending hundreds of thousands of kilometers from the planet. In the early 1980s, NASA's two Voyager spacecraft revealed that Saturn's rings are made mostly of water ice, and they found "braided" rings, ringlets, and "spokes" — dark features in the rings that circle the planet at different rates from that of the surrounding ring material. Material in the rings ranges in size from a few micrometers to several tens of meters. Two of Saturn's small moons orbit within gaps in the main rings.

Saturn's largest satellite, Titan, is a bit bigger than the planet Mercury. (Titan is the second-largest moon in the solar system; only Jupiter's moon Ganymede is bigger.) Titan is shrouded in a thick, nitrogen-rich atmosphere that might be similar to what Earth's was like long ago. Further study of this moon promises to reveal much about planetary formation and, perhaps, about the early days of Earth. Saturn also has many smaller "icy" satellites. From Enceladus, which shows evidence of recent (and ongoing)

surface changes, to Iapetus, with one hemisphere darker than asphalt and the other as bright as snow, each of Saturn's satellites is unique.

Though Saturn's magnetic field is not as huge as Jupiter's, it is still 578 times as powerful as Earth's. Saturn, the rings, and many of the satellites lie totally within Saturn's enormous magnetosphere, the region of space in which the behavior of electrically charged particles is influenced more by Saturn's magnetic field than by the solar wind. Hubble Space Telescope images show that Saturn's polar regions have aurorae similar to Earth's. Aurorae occur when charged particles spiral into a planet's atmosphere along magnetic field lines.

Voyagers 1 and 2 flew by and photographed Saturn in 1981. The next chapter in our knowledge of Saturn is underway, as the Cassini-Huygens spacecraft continues its exploration of the Saturn system. The Huygens probe descended through Titan's atmosphere in January 2005, collecting data on the atmosphere and surface. Cassini will orbit Saturn more than 70 times during a four-year study of the planet and its moons, rings, and magnetosphere. Cassini-Huygens is sponsored by NASA, the European Space Agency, and the Italian Space Agency.

FAST FACTS

Namesake	Roman god of agriculture
Mean Distance from the Sun	1,426.73 million km (886.53 million mi)
Orbit Period	29.4 Earth years (10,755.7 Earth days)
Orbit Eccentricity (Circular Orbit = 0)	0.0541506
Orbit Inclination to Ecliptic	2.484 deg
Inclination of Equator to Orbit	26.73 deg
Rotation Period	10.656 hours
Equatorial Radius	60,268 km (37,449 mi)
Mass	95.16 of Earth's
Density	0.70 g/cm ³
Gravity	7.207 m/sec ² (23.64 ft/sec ²)
Atmosphere Primary Components	hydrogen, helium
Effective Temperature	−178 deg C (−288 deg F)
Known Moons*	47

Rings

7 main rings (C, B, A, D, F, G, E)

*As of November 2005.

SIGNIFICANT DATES

1610 — Galileo Galilei reports seeing odd appendages on either side of Saturn.

1979 — Pioneer 11 is the first spacecraft to reach Saturn, flying within 22,000 kilometers (13,700 miles) of the ringed planet's cloud tops.

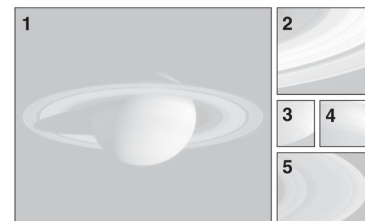
1981 — Using Saturn's powerful gravity as an interplanetary "slingshot," Voyager 2 is placed on a path toward Uranus, then Neptune, then out of the solar system.

1994 — The Hubble Space Telescope finds evidence of surface features beneath the hazy atmosphere of Saturn's largest moon, Titan.

2004 — After a seven-year journey, the Cassini-Huygens spacecraft becomes the first spacecraft to orbit Saturn; 76 orbits of Saturn and 45 Titan flybys are planned for the four-year mission.

2005 — The Huygens probe successfully lands on Titan, returning images of the complex surface.

ABOUT THE IMAGES



1 Cassini captured this true-color image of Saturn and its magnificent rings.

2 A natural-color close-up view of Saturn's rings.

3 This Cassini image shows a bright storm in a region of high atmospheric activity.

4 Saturn's bright equatorial region displays swirls and eddies in this Cassini image.

5 An ultraviolet image of Saturn's rings shows more ice (turquoise colors) near the outer edge of the rings.

FOR MORE INFORMATION

solarsystem.nasa.gov/planets/profile.cfm?Object=Saturn

March 2009 Featured Observing Object:

Saturn Finder Chart

For information about Saturn: <http://saturn.jpl.nasa.gov/>

To view: unaided eyes, binoculars, or telescope

During March 2009, look for Saturn above the eastern horizon after sunset. The brightest star-like object you see in that direction is the planet Saturn.

Look at Saturn through the telescope and see what Galileo saw 400 years ago: Saturn has extensions, or as Galileo called them, “handles”. He also described them as possibly very large moons almost touching the planet. His telescope did not have the resolution of later telescopes. These “handles” were later found to be rings made of dust, ice, and rocks.

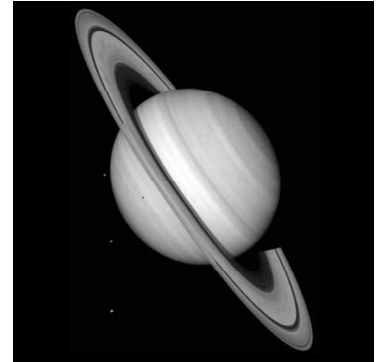


Image credit: NASA/JPL





Light Pollution and Shielding

How Shielding Lights Can Protect Our Dark Skies

About the Activity

This demonstration will illustrate the effects of lighting on our view of the night sky and how shielding can reduce light pollution while at the same time making the lighting more effective. Use the Handout to measure how bright your sky is.

All of the activity materials are provided in the GLOBE at Night Leader Toolkit.

<http://www.globe.gov/GaN/>

This demonstration is adapted from an activity on the Paper Plate Education website:

<http://analyzer.depaul.edu/paperplate/lights.htm>.

Materials Needed

- Two "Mini-lights" (such as the Mini Maglite flashlight)
- Small cardboard box or sheet of cardboard to make a box
- Cardboard for the Paper cube planetarium
- Tape
- Pin for making "stars"
- PVC cap or other items to act as shields
- White poster board if using outside, or ceiling in a dark room
- *Optional:* Picture book with landscapes or city scenes, such as "There Once Was A Sky Full of Stars" by Bob Crelin

Topics Covered

- Types of Light Pollution
- How good lighting can increase visibility and decrease energy costs.

Participants

School, youth groups ages 5 and up, as well as families and the general public. Any number of visitors can participate.

Location and Timing

This activity can be done in a darkened room or at a star party, after dark. It takes about 5-10 minutes.

Set Up

- Make the cardboard into a cube using the template below.
- Punch "star" holes with a pin into the top and cut a hole into the bottom to fit the mini-light.

Included in This Activity

Detailed Activity Description
Helpful Hints
Background Information
Cube Template
GLOBE at Night Handout



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Copies for educational purposes are permitted.

Additional astronomy activities can be found here: <http://nightsky.jpl.nasa.gov>



Detailed Activity Description

- Make sure you are in a very dark room with a low ceiling if inside. Set up the activity on a table with a white surface. If you are doing this activity outside, use a white surface above to project the stars onto.

- If you'd like to include a landscape or city scene as part of the demo, prop open the book to the page with the desired illustration (A).

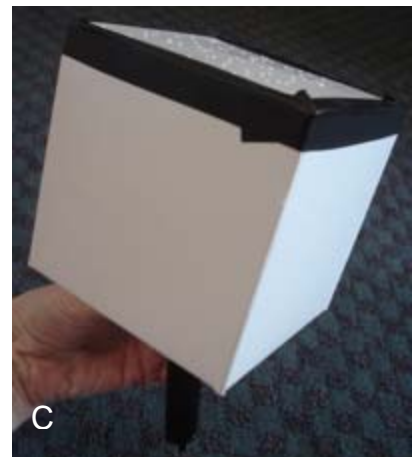


- Unscrew the reflectors from both “Mini-lights” and turn on one of them (“candle mode”). You can use the reflector ends as a base to stand the lights on the table (B).



- Place the bulb top of the “Mini-light” barely into the big hole at the bottom of the white paper cube (C).

- With the room lights off, project the “stars” from the white paper cube onto the ceiling. Observe how many stars you



can see and how bright they appear. If using outside, place the posterboard above to project the stars onto.

- Using the second “Mini-light” as a “street light.” Place it on the table (in front of the landscape if you are using it) and turn it on (D).

- What do you notice about the number of stars?

- Now place the PVC cap (or another shield) above the second mini light to represent a shielded streetlight (E).

- What differences do you notice with and without the shield? How is your view of the stars affected? How does the lighting of the area directly under the lamp change?



Wrap Up

Discuss your observations and the benefits of shielded lighting. Note that shielded lighting improves our view of the stars (reduces sky glow), and is safer and more energy efficient, since it directs light down to the ground, where we want lighting rather than up into the sky. This improves the quality of life for people, animals, and plants; saves money and energy; and preserves our beautiful dark skies.

Encourage star party participants to take part in a citizen science project to measure light pollution. The **GLOBE at Night Observation Handout** below gives visitors an opportunity to make sky quality measurements and become part of a global science project on light pollution. Find out more on the GLOBE at Night website, below.

Background Information

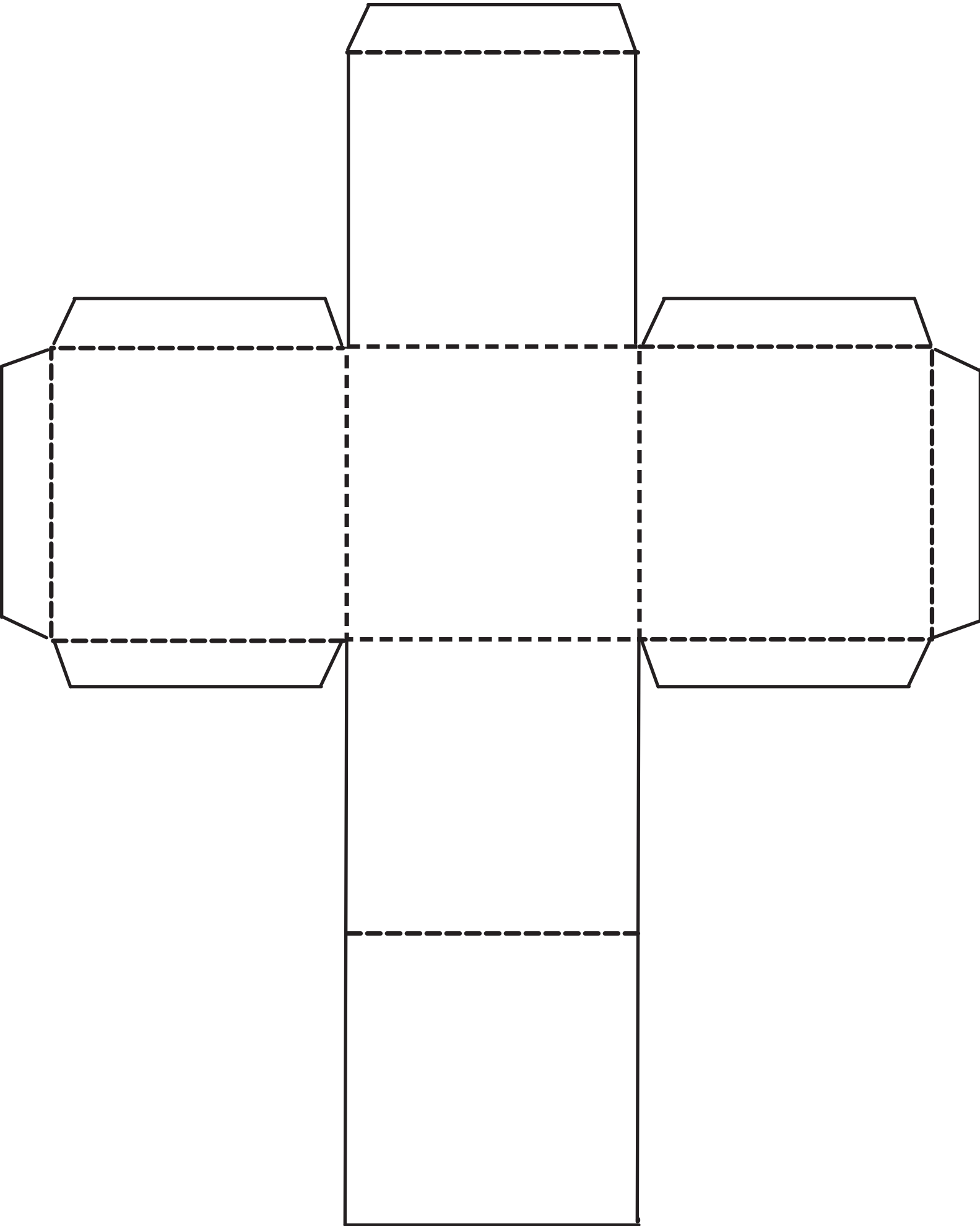
Below are many websites with valuable information on light pollution, good lighting, and how to make a difference in your community.

- International Dark Sky Association - <http://www.darksky.org/>
- GLOBE at Night - <http://www.globe.gov/GaN/>
- Nightwise - <http://www.nightwise.org/>
- Great Worldwide Star Hunt - <http://www.starcount.org/>
- Lights Out America - <http://www.lightsoutamerica.org/>
- National Park Service Dark Sky Team - <http://www2.nature.nps.gov/air/lightscapes/>
- Astronomical League – <http://www.astroleague.org>
- IYA 2009 Dark Skies national website – <http://astronomy2009.us/darkskies/>
- IYA 2009 Dark Skies international website – <http://www.darkskiesawareness.org>



Cube Pattern

Cut on solid lines - Fold on dashed lines



GLOBE at Night

Observation Sheet March 16-28, 2009

To observe, go outside at least 1 hour after sunset to a dark area and wait 10 minutes for your eyes to dark-adapt. Then look to the west to locate the constellation Orion and compare it to the magnitude charts below. Submit this sky quality reading online to get your neighborhood on a global map of sky quality readings.

www.globe.gov/globeatnight

Only fields marked by * are required.

*Date: March ____, 2009

*Observation Time: ____:____ PM local time (HH:MM)

*Country: _____

*Latitude (in deg/min/sec or decimal degrees): ____ deg ____ min ____ sec (North / South)
____ decimal degrees

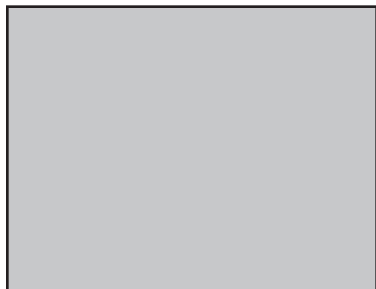
*Longitude (in deg/min/sec or decimal degrees): ____ deg ____ min ____ sec (East / West)
____ decimal degrees

Websites to help look up your position:

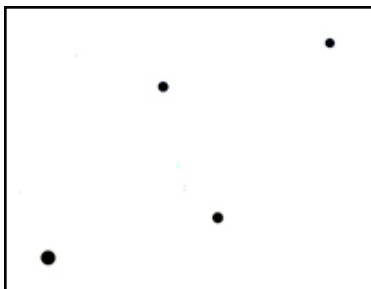
www.itouchmap.com/latlong
<http://maporama.com>

Comments on location: (e.g. There is one street light within 50 m that is shielded from my view.)

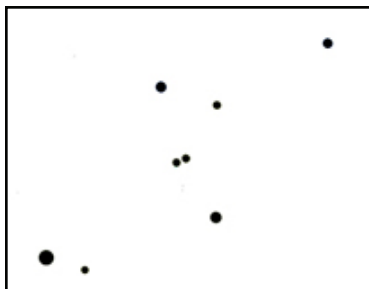
*Match your nighttime sky to one of our magnitude charts :



☐ Cloudy Sky



☐ Magnitude 1 Chart



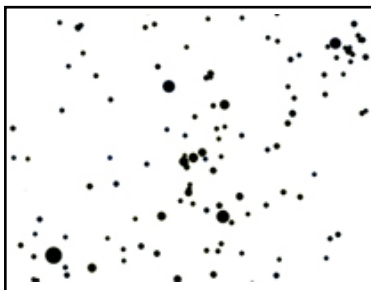
☐ Magnitude 2 Chart



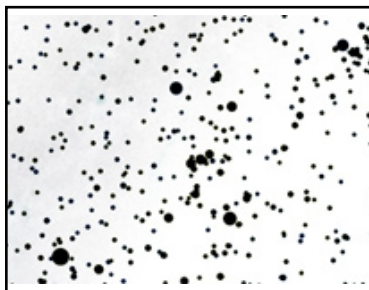
☐ Magnitude 3 Chart



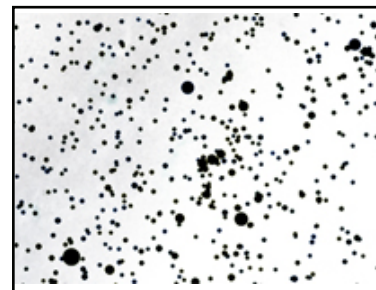
☐ Magnitude 4 Chart



☐ Magnitude 5 Chart



☐ Magnitude 6 Chart



☐ Magnitude 7 Chart

*Estimate the cloud cover in the sky:

☐ Clear

☐ Clouds cover 1/4 of sky

☐ Clouds cover 1/2 of sky

☐ Clouds cover > 1/2 of sky

Comments on sky conditions: (e.g. a little haze to the north)

Report online at www.globe.gov/globeatnight/report.html



The Night Sky Network's International Year of Astronomy (IYA) Discovery Guides are supported and sponsored by these NASA Forums and missions:

Space Telescope Science Institute's [Origins Education Forum](#)

Special Advisor: Denise Smith

NASA [JPL's PlanetQuest Exoplanet Exploration Program](#)

Special Advisor: Michael Greene

NASA [Lunar CRater Observation and Sensing Satellite \(LCROSS\)](#)

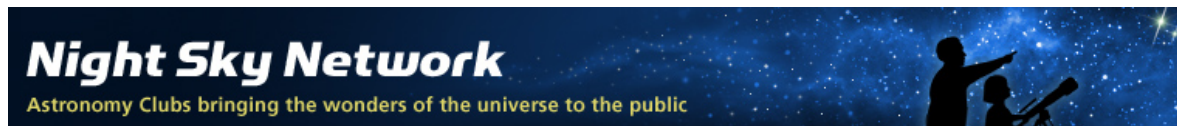
NASA [Education Forum on the Structure and Evolution of the Universe](#)

NASA [Education Forum on Solar System Exploration](#)

NASA [Education and Public Outreach at Sonoma State University](#)

NASA Goddard Space Flight Center [Suzaku Mission E/PO Program](#)

NASA's [Kepler Discovery Mission](#)



[The Night Sky Network](#) is a nationwide coalition of amateur astronomy clubs bringing the science, technology, and inspiration of NASA's missions to the general public.

We share our time and telescopes to provide you with unique astronomy experiences at science museums, observatories, classrooms, and under the real night sky.

<http://nightsky.jpl.nasa.gov>

The International Year of Astronomy
(<http://astronomy2009.us>) aims to help citizens of the world rediscover their place in the Universe through the daytime and nighttime sky. Learn more about NASA's contributions to the International Year of Astronomy at <http://astronomy2009.nasa.gov>

